

**REMARKS**

Claims 1-23 are currently pending. The specification has been amended in several instances as described below. Figures 3, 4 and 19 have been amended as described below. Claim 13 has been amended with regard to punctuation, and claim 17 has been amended to correct a typographical error. Claim 20 has been amended for grammar, and claim 22 has been amended with respect to matters of form. The changes to claims 13, 17, 20 and 22 are not intended to be related to patentability or to narrow the scope of the affected claim elements.

The Office Action includes an objection to the drawings for alleged informalities. Figures 3 and 4 have been amended to include the reference numeral "12a" in a manner that addresses the Office's first comment. With regard to the Office's second comment concerning Figure 15, the specification has been amended to change reference numeral "12a" to reference numeral "12b" at page 32 of the specification, thereby addressing the Office's objection. No change to Figure 15 is required. In addition, Figure 19 has been amended to change reference numeral "17a" to "17c", given that reference numeral "17a" is already used for a different feature (e.g., in Figures 1 and 2). A corresponding change has been made at page 35 of the specification. Withdrawal of the objections is respectfully requested.

The Office Action includes a rejection of claims 1 and 2 under 35 U.S.C. §103(a) as allegedly being unpatentable over the *Schmid* patent (DE 3617799). This rejection is respectfully traversed.

Claim 1 recites an optical module comprising an optical element, a supporting element configured to support the optical element, and a first optical fiber having a first end optically coupled to the optical element and a second end placed near to the supporting element. The optical module also comprises a second optical fiber fusion-spliced to the first optical fiber.

The Office alleges that the *Schmid* patent discloses all the features recited in claim 1 except for a fusion splice between a first optical fiber and a second optical fiber. The Office further alleges that fusion splicing is well known in the art for the purpose of connecting two optical fibers together, and that it would have been obvious for one of ordinary skill in the art to use a fusion splice to connect the two fibers disclosed in the *Schmid* patent. Applicants respectfully disagree.

Applicants respectfully submit that the Office's rejection does not make out a *prima facie* case of obviousness at least because one of ordinary skill in the art would not have been motivated to use a fusion splice to connect the two fibers disclosed in the *Schmid* patent. First, Applicants submit that one of ordinary skill in the art would not have been motivated to use a fusion splice to connect the fibers disclosed therein because it is believed that to do so would render the device unsuitable for its intended purpose. The *Schmid* patent discloses splicing two different types of fiber -- a step-index fiber 6 and a graded-index fiber 7 -- wherein the core radius AS of the step-index fiber 6 is selected relative to the core radius AG of the graded-index fiber 7 such that the numeric aperture of the step-index fiber 6 is less than the numeric aperture of the graded-index fiber 7, and wherein

additional absorption at the splice 8 of the step-index fiber 6 and the graded-index fiber 7 does not develop in view of the selected characteristics of the cores. (See Figure 2 of the *Schmid* patent and the middle of the translation provided by the Office.) As understood by those of ordinary skill in the art, fusion splicing is used to melt one terminal end surface of a fiber into that of another fiber by heating up and melting the portion to be connected. In the case of the *Schmid* device, using a fusion splice to connect the step-index fiber 6 to the graded-index fiber 7 (i.e., two different types of fiber with different and particular core and index characteristics) would alter the distributions of refractive index at the splice 8 in both fibers 6 and 7 from the intended index distributions disclosed in the *Schmid* patent, and would also alter the intended relationship at the splice 8 between the core radii of the two fibers 6 and 7 disclosed in the *Schmid* patent. As a result, the above-noted intended characteristics of the device disclosed in the *Schmid* patent in connection with Figure 2 therein would not be obtained. Accordingly, for at least these reasons, one of ordinary skill in the art would not have been motivated to use a fusion splice in the *Schmid* device. Accordingly, claim 1 is patentable over the *Schmid* patent for at least these reasons. Withdrawal of the rejection and allowance of claim 1 is respectfully requested for at least these reasons. Claim 2 is allowable at least by virtue of dependency.

Moreover, Applicants respectfully traverse the Office's assertion of well-known prior art. Should the Office maintain this ground of rejection, Applicants request that the Office cite a reference to support its assertion so that the true content of the prior art can be properly evaluated within the context of the field of the presently claimed invention.

Applicants note that where fusion splicing is used, the fibers being spliced are normally of the same type. In this instance, however, the Office is asserting that one of ordinary skill in the art would have motivated to splice a graded-index fiber to a step-index fiber. In addition, the *Schmid* patent discloses special conditions for the fibers 6 and 7 relating to core radii, numerical apertures, and absorption at the splice 8, and given such conditions, it is believed that the Office should not rely on official notice for alleged motivation for the Office's suggested modification of the *Schmid* device.

Moreover, there are additional reasons why one of ordinary skill in the art would not have been motivated to use a fusion splice in the *Schmid* device. To obtain good performance and minimum dissipation at the connection of two fibers in a fusion splice, the cut state of the terminal end surfaces of the fibers must be in excellent condition, and a stable arc discharge is required. In the case of the *Schmid* patent, the Office has not specified how the fusion splicing would allegedly be carried out. Given the configuration of the *Schmid* device, it would appear extremely difficult to securely hold a fiber for cutting it at the position of the splice 8. Without being securely held, a poor quality cut would likely be obtained, and the severed surface of the fiber would likely be rough with regard to the state of inclination, protrusion, etc.

Moreover, to obtain a good fusion splice, the fibers being spliced must be held securely and must be separated from other objects and surrounding material by several millimeters to centimeters. In the case of the *Schmid* patent, it would appear extremely difficult to achieve these requirements given the configuration of the *Schmid* device

illustrated in Figure 1 of the *Schmid* patent wherein the fibers are closely supported by the substrate. Accordingly, these difficulties provide additional reasons why one of ordinary skill in the art would not have been motivated to use a fusion splice in the *Schmid* device.

For at least the above-noted reasons, Applicants respectfully submit that claims 1 and 2 are not obvious in view of the *Schmid* patent. Withdrawal of the rejection and allowance of claims 1 and 2 are respectfully requested.

The Office Action also includes a rejection of claims 3, 4, 20 and 21 under 35 U.S.C. §103(a) as allegedly being unpatentable over the *Schmid* patent in view of the *Enomoto et al.* Publication (U.S. Patent Application Publication No. 2002/0003926). This rejection is respectfully traversed.

Independent claim 3 recites an optical module comprising an optical element, a supporting element configured to support the optical element, a first optical fiber optically coupled to the optical element, and a second optical fiber connected to the first optical fiber. The optical module further comprises a resin element which is supported by the supporting element and with which a connected portion between the first optical fiber and the second optical fiber is covered.

The Office alleges that the *Schmid* patent discloses all of the features recited in independent claim 3 except for using a resin material as the coating material 14 disclosed therein. The Office further states that the *Enomoto et al.* publication discloses that it is known when the peripheral surface of a multi-mode optical fiber is covered with a resin, the cladding modes disappear. The Office alleges that it would have been obvious to one

of ordinary skill in the art to use a resin cladding mode stripper as disclosed in the *Enomoto et al.* publication as the cladding mode stripper 14 disclosed in the *Schmid* patent in order to remove unwanted modes. In addition, the Office also suggests that use of a resin as suggested by the Office would be advantageous for covering and reinforcing the splice and for fixing the optical fibers 6 and 7 to the supporting element 2.

Applicants respectfully submit that the Office's rejection does not make out a *prima facie* case of obviousness with regard to claims 3, 4, 20 and 21. First, one of ordinary skill in the art would not have been motivated to use a resin material as the cladding mode stripper 14 in the *Schmid* device to remove unwanted modes based upon the disclosure in the *Enomoto et al.* patent at least because the *Schmid* patent teaches away from doing so. In particular, the *Enomoto et al.* patent discloses that use of resin in this manner makes cladding modes disappear. However, the translation of the *Schmid* patent provided by the Office states, "The coat modes must not be completely eliminated." (See top of page 2 of the translation provided by the Office). Accordingly, the *Schmid* patent teaches away from making all of the coating modes (cladding modes) disappear. Thus, one of ordinary skill in the art would not have been motivated to use resin as suggested by the Office according to the disclosure in the to remove unwanted modes for at least this reason.

Second, one of ordinary skill in the art would not have been motivated to replace the material 14 of the *Schmid* device with resin for the purposes of covering and reinforcing the splice and for fixing the optical fibers 6 and 7 to the supporting element 2, because one of ordinary skill in the art would reasonably expect that the materials 13 and

14 of the *Schmid* device already serve these purposes. In particular, the last five lines of the translation provided by the Office states that the material 13 fixes the fiber 6 in the serration 3 and that the material 14 covers the splice 8. Thus, the Office's assertions in this regard do not provide motivation for one of ordinary skill in the art to replace the materials 13 and 14 with resin.

For at least these reasons, withdrawal of the rejection against claim 3 and allowance of the same are respectfully requested.

With regard to claim 4, the Office's rejection repeats the assertion that fusion splicing is well known in the art and that one of ordinary skill in the art would have been motivated to use fusion splicing to splice the two fibers of the *Schmid* device. Applicants respectfully submit that claim 4 is allowable at least by virtue of dependency from claim 3. Accordingly, withdrawal of the rejection and allowance of claim 4 is requested for at least this reason. Moreover, Applicants submit that claim 4 is further allowable at least for reasons similar to those set forth above for claims 1 and 2.

Claim 20 recites a method of manufacturing an optical module, comprising the steps of supporting a first optical fiber on a supporting element while optically coupling an optical element supported on the supporting element to the first optical fiber, fusion-splicing the first optical fiber to a second optical fiber longer than the first optical fiber to each other, and inserting a fusion-spliced portion between the first optical fiber and the second optical fiber into a sleeve. The method further comprises packing resin into the sleeve in which the fusion-spliced portion is inserted.

The Office alleges that the *Schmid* patent discloses all of the claimed steps except for: use of a resin element as a coating material, use of fusion splicing, and use of a sleeve in which the fusion-spliced portion is inserted. The Office asserts that one of ordinary skill in the art would have been motivated to use resin for the purpose of removing unwanted modes, for covering and reinforcing the splice of the *Schmid* device, and for fixing the optical fibers of the *Schmid* device to the supporting element. The Office further alleges that the use of fusion splicing is well known and further that it is well known in the art to pack resin into a sleeve in order to reinforce a fiber splice within the sleeve, and that one of ordinary skill in the art would therefore have been further motivated to modify the optical module disclosed in the *Schmid* patent by using a sleeve and packing resin into the sleeve to provide reinforcement and protection for the spliced fibers disclosed in the *Schmid* patent.

Applicants respectfully submit that the Office's rejection does not make out a *prima facie* case of obviousness with regard to claim 20. First, as discussed with regard to claim 3, the translation of the *Schmid* patent provided by the Office states that the coat modes must not be completely eliminated. Therefore, one of ordinary skill in the art would not have been motivated to modify the *Schmid* device as suggested by the Office, as the *Schmid* patent specifically teaches away from completely removing coating modes (cladding modes).

In addition, Figure 3 of the *Schmid* patent shows that the two fibers 6 and 7 of the *Schmid* device are inserted into a groove 3, referred to in the translation provided by the



Office as a "serration". Applicants respectfully submit that one of ordinary skill in the art would not have been motivated to use a sleeve as suggested by the Office because the groove 3 of the *Schmid* device would reasonably be viewed by one of ordinary skill in the art as already providing reinforcement and protection to the optical fibers 6 and 7, particularly in view of the fact that Figure 3 of the *Schmid* patent illustrates these fibers being fixed by materials 13 and 14. Thus, use of an additional sleeve surrounding the fibers would reasonably be viewed by one of ordinary skill in the art as increasing the complexity and difficulty of fabrication of the device without providing associated benefits or functionality. Accordingly, one of ordinary skill in the art would not have been motivated to make the Office's suggested modification of the *Schmid* device for at least this reason.

In addition, Applicants respectfully traverse the Office's assertion of well-known prior art in connection with the use of a sleeve and request that the Examiner cite a reference to support the assertion so that the true content of the prior art can be properly evaluated within the context of the field of the presently claimed invention.

For at least the above-noted reasons, withdrawal of the rejection against claim 20 and allowance of the same are respectfully requested. Claim 21 is allowable at least by virtue of dependency from claim 20.

The Office Action also includes a rejection of claims 3, 5, 6, 8 and 9 under 35 U.S.C. §103(a) as allegedly being unpatentable over the Naitoh patent (U.S. Patent No. 5,680,493). This rejection is respectfully traversed.

The Office alleges that the *Naitoh* patent discloses all of the features recited in claim 3 except that the *Naitoh* patent does not explicitly state whether a connected portion between the first and second fibers 23a and 23 disclosed therein is covered by resin. The Office further suggests that it would have been obvious to one of ordinary skill in the art to cover the connected portion between the two fibers 23a and 23 of the *Naitoh* device with resin for the purpose of aligning the two fibers with each other and to secure and strengthen the connection between the two fibers.

Applicants respectfully submit that the Office's rejection does not make out a *prima facie* case of obviousness at least because it does not specify what alleged modification would hypothetically be made to the *Naitoh* device, and to method of construction thereof, in order to achieve the Office's suggested goal of covering the connection point between the first and second fibers 23a and 23 with resin. In particular, the *Naitoh* patent discloses that the quartz ferrule 24 fixes the second optical fiber 23 using epoxy resins. The *Naitoh* patent further discloses that an ultraviolet ray setting resin is applied to the first optical fiber 23a, which is then allocated to the base 26 in the direction of the arrow H as illustrated in Figure 6. The first optical fiber 23a is then inserted into the ferrule 24 and is contacted with the surface G of the second optical fiber 23. Then an ultraviolet ray is irradiated from above for unifying the first optical fiber 23a and the second optical fiber 23. After the optical fibers 23a and 23 are unified, the first optical fiber 23a is fixed to the base 26. (See column 2, lines 20-40 of the *Naitoh* patent.)

The disclosure of the *Naitoh* patent, however, does not specifically disclose how resin is allocated near the connection point of the first and second optical fibers 23a and 23. For example, if resin is applied to the optical fiber 23a near, but not at, the end of that fiber, resin would tend to be pushed away from the end of the fiber 23a, and thus away from the connection point, as the fiber 23a is inserted into the ferrule 24. Notwithstanding such complexities, the Office's rejection provides no explanation of how the *Naitoh* device and the fabrication method thereof would be modified to achieve coverage of the connection point with resin. Accordingly, if the Office maintains this ground of rejection, the Office is respectfully requested to explain exactly what type of modification is being suggested that would result in covering the connection point of the two optical fibers 23a and 23 with resin. For at least the above-noted reason, withdrawal of the rejection and allowance of claim 3 is respectfully requested. Claims 5, 6, 8 and 9 are allowable at least by virtue of dependency from claim 3.

The Office Action also includes a rejection of claims 13-17 under 35 U.S.C. §103(a) as allegedly being unpatentable over the *Naitoh* patent in view of the *Kurata* patent (U.S. Patent No. 5,018,821). This rejection is respectfully traversed.

Claims 13-17 depend either directly or indirectly from claim 3. Accordingly, Applicants respectfully submit that claims 13-17 are allowable at least by virtue of dependency from claim 3. In addition, Applicants traverse the Office's statement that it is well known to use any type of resin to serve as an optical matching material. As noted by the Office, the *Naitoh* patent discloses an ultraviolet setting resin 39, which has a refractive

index matched to that of the optical fiber 36. However, it is respectfully submitted that such disclosure does not provide a basis for a general conclusion that any type of resin can be used as an optical matching material.

The Office Action includes an objection to claims 7, 10-12, 18, 19, 22 and 23 as being dependent upon a rejected base claim, but otherwise allowable. It is believed that these claims are allowable in their present form in view of the remarks set forth above relating to the patentability of independent claims 1, 3 and 20. Accordingly, allowance of claims 7, 10-12, 18, 19, 22 and 23 is respectfully requested.

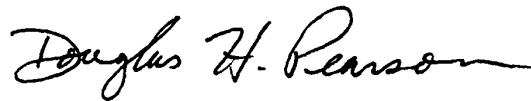
In light of the foregoing remarks, withdrawal of the objections and rejections of record are respectfully requested so that the present application may pass to issuance. Should there be any questions in connection with this application, the Office is invited to contact the undersigned at the number below.

Respectfully submitted,

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